Exhibit A
to Declaration Under 37 C.F.R. § 1.131
executed by inventor Charles A. Miller

FormFactor, Inc.

Invention Disclosur Form

This Invention Disclosure Form ("IDF") is intended to serve as the starting point for evaluating your invention. While it is expected that various aspects of your invention will be explored in greater detail during an in-person meeting with a FormFactor Patent Attorney, please take the time to work through this IDF, which should assist you in defining and describing your invention. If you have a lengthy report or study concerning your invention, or if your laboratory notebook includes an explanation or discussion of your invention, please include a copy of such materials with your submission of this IDF. If two or more individuals contributed to the invention, please have all such individuals participate in the preparation of this IDF.

Please forward the completed IDF to the Legal Department, Attn: Intellectual Property Coordinator. Thank you.

1. Title of Invention: **A High Density Packaging and Cooling Apparatus for Electronic Components**
(Provide a brief, several word description of the invention.)

2. Inventors: **Chuck Miller**
(Identify all individuals who contributed to the subject matter of the invention, even if they did not physically work together at the same time, or each did not make the same type or amount of contribution to the invention.)

3. Description/Disclosure:

(a) Describe in detail the construction and operation of the invention, along with the intended and any potential applications or uses of the invention. This description should include any presently contemplated alternate means of construction or alternate methodologies. Sketches, prints, lab notebooks and reports of any nature in which the invention is referred to should form a part of this description. Please feel free to attach copies of any such materials.

Electronic Components are mounted on a ceramic substrate and covered in an enclosed and seal cavity in which coolant is circulated.

(b) Identify the features of the invention that are believed to be new or otherwise provide an advantage over existing constructions, solutions or methodologies.

1. Utilization of MicroSpring technology in this apparatus allows:

a. **High Packaging Density; Packaged component area is the same as the die footprint**
b. **Cooling of both sides of the die and hence lower thermal gradients are achieved across the die.**
c. **Cooling method that allows flip chip/area array connection of the die to the substrates and allows direct liquid cooling on the active surface of the die. This minimizes temperature variation across the die and therefore improved uniformity of output signals such as rise time and pin to pin skew.**
d. **High density electrical interconnect**
e. **A method of achieving electrical interconnects to both the top and bottom of the assembly simultaneously.**
f. **A low cost method of assembly**
g. **A method of disassemble for maintenance and repair**

(c) If there is more than one inventor, identify the general subject matter contribution made by each inventor.

Chuck Miller; Electrical Interconnect Structures of this present invention, method of c ling, mechanical structure.

(d) Identify the technical problems solved or addressed by the invention, or the advantages over prior solutions.

See 3 (b) 1 Above

(e) Identify any practical importance of the invention of which you are aware, e.g., cost savings or efficiencies.

See 3 (b) 1 Above

(f) Identify as accurately as possible the date the invention was first conceived and the earliest written description of the invention. A copy of this written description should be attached if it was not already in relation to a prior section of this IDF.

1/23/01

(g) Describe the current developmental status of the invention, e.g., under preliminary experimentation, planning for practical usage, and the anticipated date of introduction, if presently known, into a product or device that will be delivered to a customer.

under preliminary experimentation and planning for practical usage in late 2001 or 2002

(h) If the invention was the product of a cooperative development with another company or with one or more individuals who are not FormFactor employees, please identify these individuals and their employers.

NA

4. Public Disclosure:

(a) Describe all disclosures to third parties, even if disclosures were made under a confidentiality or non-disclosure agreement or for experimentation or testing only.

Third Party(ies):
Date(s) of Disclosure:
Brief description of scope and extent of disclosure(s):

Mark here if there has been no disclosure to a third party: ☒

(b) Has a product or device implementing the invention been offered for sale or described as available? If yes, identify:
Third Party(ies):
Date(s) of Offer:
Brief description of offer for sale or of availability:

Mark here if no offer has been made: ☒

5. Prior Devices or Methodologies:

(a) Describe old or existing devices or methods, if any, of performing the function of the invention or prior solutions to the problems/issues addressed by the invention. (Please also identify and attach any patents, journal publications, articles, brochures, etc. of which you are aware that disclose or discuss such prior methods or products).

The use of flip chip to achieve high density MCM (multichip modules) is standard practice. For high density, where die tiling is desired, flip chip techniques must be used. Historically this has meant solder bump die with area array interconnects. The die are underfilled with epoxy to achieve interconnect reliability. For high power devices, cooling is provided to the back side of the die through conduction, forced convection or liquid cooling such as florinert. This method does not allow liquid cooling of the active side of the die, so there will be a temperature gradient between the active and back side of the die. This creates larger thermal variation in the junction temperatures. The IBM Thermal Conducti n Module is a clasic example of a flip chip MCM with back side cooling.

(b) Identify the disadvantages or problems of the old or existing methods or devices, or how the prior or existing solutions have failed to solve problems solved by the invention.

As referenced above, you can not liquid cool the active side of the die for C4 devices. The MOST chips provide a standoff that allows the cooling fluid to run between the substrate and the active surface of the die to give uniform cooling even for high power applications. The variation in electrical connection shown on sheets 2 and 3 are simple variations in the use of MicroSprings.

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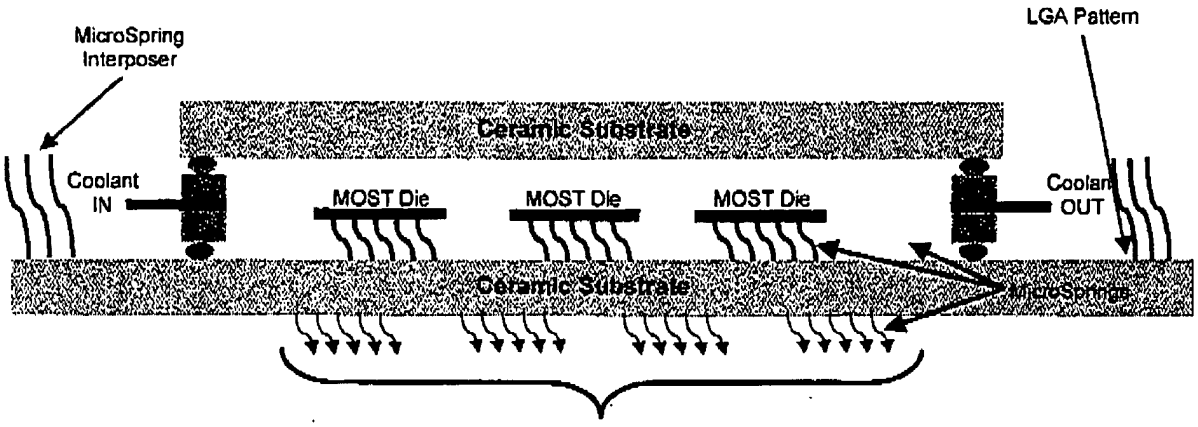
Physical Illustration of Package and Cooling Assembly Utilizing MOST DIE Soldered to Ceramic Electrical connection is routed to edge of substrate



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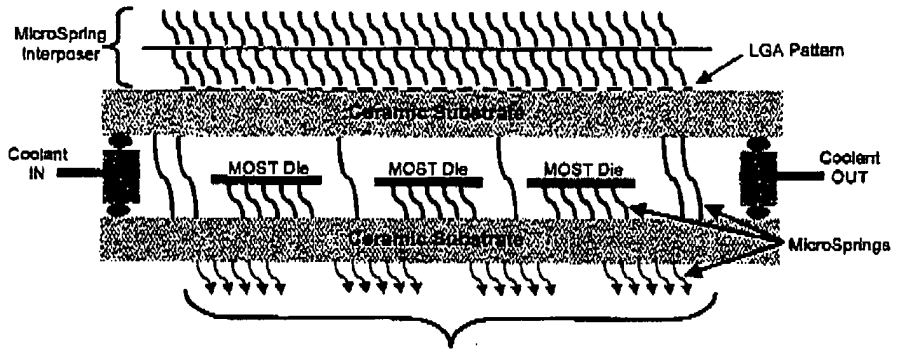
Physical Illustration of Package and Cooling Assembly Utilizing MOST DIE Soldered to Ceramic



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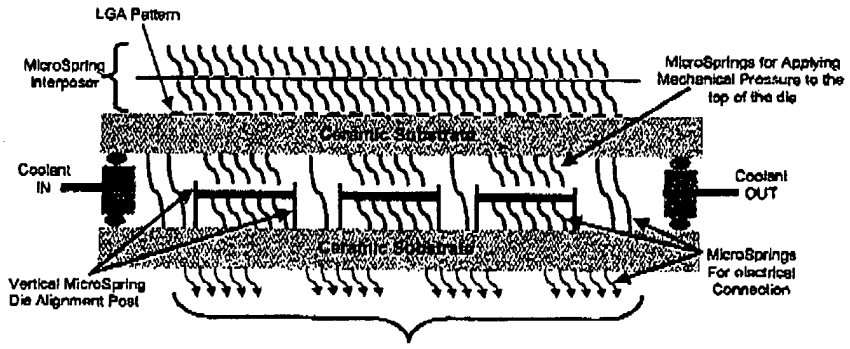
Physical Illustration of Package and Cooling Assembly Utilizing MicroSpring "Socket" attached to Ceramic



Inventor: Chuck Miller
Signature: _____
Date: Jan 25, 2001